



Technical Assistance Services for Communities

West Lake Landfill Superfund Site Fact Sheet – May 2016

Baseline Human Health Risk Assessment (BHHRA)

Introduction

EPA listed West Lake Landfill on the Superfund program's National Priorities List in 1990. To manage the cleanup, EPA divided the 200-acre site into two areas, or operable units (OUs) – Areas 1 and 2. OU1 addresses radiologically contaminated areas. OU2 addresses other landfill areas, including the Bridgeton Sanitary Landfill. See Figure 1. *[Note: the subsurface smoldering event location shown in Figure 1 is not up to date.]*

In 2016, EPA decided that groundwater would be addressed separately from OU1 and OU2 as OU3.

The site's responsible parties completed a Baseline Human Health Risk Assessment (BHHRA) for OU1 and EPA approved it in 2000. The BHHRA identified several contaminants of potential concern:

- Eight radionuclides (uranium-238, -235 and -234, thorium-232 and -230, radium-226, lead-210, and protactinium-231).
- Three trace metals (arsenic, lead and uranium as a metal).
- One polychlorinated biphenyl (Aroclor 1254).

This fact sheet provides information on BHHRAs and briefly discusses the 2000 BHHRA for OU1. The 2000 BHHRA for OU1 helped EPA determine the need for remediation of OU1. A separate BHHRA was completed for OU2, and a separate BHHRA will be required for OU3.

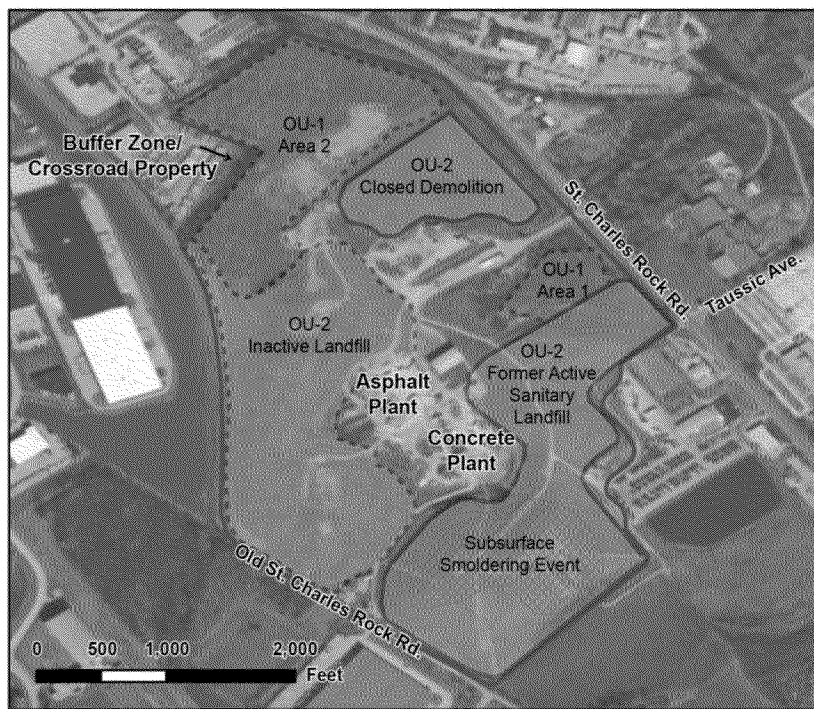
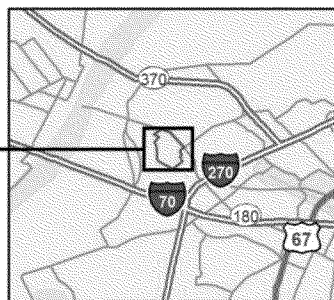


Figure 1. West Lake Landfill (2014)

West Lake Landfill Site Location and Layout



Legend

- Site Boundary
- OU-1 (Radiological Areas)
- OU-2 (Nonradiological Areas)
- EPA Oversight
- MDNR Oversight
- Subsurface Smoldering Event

Sources: Esri, DeLorme, AND, Tele Atlas, First American, UNEP-WCMC, USGS.

What Is the Purpose of a BHHRA?

A BHHRA helps people understand potential risks to human health from exposure to contaminants at a Superfund site (OU1 at West Lake Landfill in this case) and supports site decision-making. If any significant new information is discovered

later, the BHHRA can be updated. For example, a remedial investigation addendum report is expected to be completed for OU1 in 2016. This report will assess whether additional data collected after the 2000 BHHRA are likely to change the results of the 2000 BHHRA. The 2000 BHHRA could be updated based on this assessment.

Site-specific cleanup levels at Superfund sites are set based on the results of the BHHRA, in order to protect human health.

How Is a BHHRA Performed?

A BHHRA has four steps:

1. Data evaluation
2. Exposure assessment
3. Toxicity assessment
4. Risk characterization

1. Data evaluation takes place during the remedial investigation at a Superfund site. The investigation identifies contaminants and their locations and concentrations. A remedial investigation for OU1 finished in April 2000. Due to community concerns, additional sampling and investigations are ongoing. Their completion is expected in 2016.

2. Exposure assessment is also part of the remedial investigation. The exposure assessment determines where exposure(s) could happen and who could be exposed to site contaminants, both now and in the future. A conceptual model identifies all possible pathways by which a person could be exposed. Exposure pathways include how and where people could come in contact with contaminated soil, water or air. Examples of these pathways are accidental ingestion of contaminated soil or water, or breathing of contaminated air.

If contaminants have migrated off site in soil, air or groundwater, the assessment also investigates these possible exposure pathways. For example, if surface soil is contaminated and could have been carried off site in rainwater, the runoff is investigated. At West Lake Landfill, exposure assessment also includes the potential for exposure to penetrating radiation from gamma-emitting radionuclides.

Exposure pathways associated with possible future natural disasters such as fires, earthquakes, floods and tornados are typically not considered in a BHHRA. The 2000 BHHRA did not evaluate risks associated with such events. It also did not consider additional exposure pathways that could result from a subsurface smoldering event, such as is now occurring in the Bridgeton Landfill).

The exposure assessment in the 2000 BHHRA for OU1 first considered these potential exposure pathways:

- ☐ Current Exposures (2000)
 - ☐ Supervised remediation workers at OU1.
 - ☐ Groundskeepers doing grounds maintenance three times per year in areas of West Lake Landfill next to OU1.
 - ☐ Office workers in a building about 50 feet north of Area 1, within OU1. See Figure 1.
 - ☐ Trespassers, groundskeepers and storage yard workers on property surrounding West Lake Landfill, including the Ford property (also called Buffer Zone/Crossroads property).
- ☐ Future Exposures
 - ☐ Recreational users, trespassers or on-site workers such as groundskeepers, workers in adjacent buildings who cross Areas 1 and 2, and workers using OU1 for outdoor storage.

After initial evaluation, the following exposure pathways were determined to be complete and risk calculations were made:

- ☐ Current Exposures
 - ☐ Groundskeepers doing grounds maintenance three times per year in areas of West Lake Landfill next to OU1.
 - ☐ Groundskeepers for the Ford property who perform maintenance one day per week, 26 weeks per year.
- ☐ Future Exposures
 - ☐ Groundskeepers for Areas 1 and 2 of OU1 doing grounds maintenance three times per year.
 - ☐ Building user next to Areas 1 and 2 who uses portions of Areas 1 and 2 for parking and is

exposed only to gamma radiation from beneath a paved or gravel parking lot in Areas 1 and 2.

- Outdoor storage yard worker who works seven hours per day in a building next to Areas 1 and 2 and who works one hour per day outdoors on the paved or graveled area on Areas 1 and 2 and is exposed only to gamma radiation from beneath a paved or gravel parking lot in Areas 1 and 2.
- Groundskeepers for the Ford property who do maintenance work one day per week.

The 2000 BHHRA for OU1 eliminated the current exposure pathway for office workers in a building about 50 feet north of Area 1, within OU1, from further consideration. This was because the only exposure route was inhalation of re-suspended dust or radon. Negative results for air monitoring data and indoor radon measurement data collected by the landfill operator indicated that this was not a complete exposure pathway.

For both current and future scenarios, the groundskeeper and trespasser scenarios were considered similar exposures, with the groundskeeper scenarios including longer periods of exposure. Therefore, only the groundskeeper scenarios were included in risk calculations because these scenarios result in higher exposure levels than the trespasser scenarios.

Exposure point concentrations are the concentrations of contaminants used in risk calculations for each exposure scenario. Table 1 shows the current exposure point concentrations in Area 2 soil used in the 2000 BHHRA for OU1 (adapted from Table A.3-3 of the 2000 BHHRA). Different values were used for Area 1 and the Ford Property based on soil samples from those areas.

Exposure assessment makes assumptions about the behavior of people who may be exposed. For example, the 2000 BHHRA assumed that a groundskeeper would accidentally ingest 100 milligrams of soil per day. This amount of soil, the exposure point concentration and the number of days the groundskeeper is exposed are the values used in the calculation of the groundskeeper's lifetime exposure.

| Table 1: Current Exposure Point Concentrations for Area 2* 95% UCL on the Arithmetic Mean** | | | |
|---|---------------------|------------------------|--------------|
| Contaminant | Surface Soil | All Soil Depths | Units |
| <i>Uranium Series</i> | | | |
| U-238 + 2 daughters | 83.5 | 27.1 | pCi/g |
| U-234 | 156 | 46.0 | pCi/g |
| Th-230 | 8,920 | 3,730 | pCi/g |
| Ra-226 + 5 daughters | 1,130 | 338 | pCi/g |
| Lead-210 + 2 daughters | 384 | 128 | pCi/g |
| <i>Actinium Series</i> | | | |
| U-235 + 1 daughter | 5.99 | 1.83 | pCi/g |
| Pa + 8 daughters | 559 | 162 | pCi/g |
| <i>Thorium Series</i> | | | |
| Th-232 + 10 daughters | 36.6 | 15.9 | pCi/g |
| <i>Inorganic Chemicals</i> | | | |
| Arsenic | 15.9 | NE *** | mg/kg |
| Lead | 1,176 | NE | mg/kg |
| Uranium | 250 | NE | mg/kg |
| <i>Organic Chemicals</i> | | | |
| Aroclor-1254 | 1.02 | NE | mg/kg |
| Notes: * Future Exposure Point Concentration values calculated based on ingrowth of radium-226, which adds a conservative estimate of future risk. ** See August 2015 TASC fact sheet on 95% UCL. *** NE = no exposure. A person is not exposed to subsurface soil. pCi/g = picocuries per gram of soil mg/kg = milligrams per kilogram of soil | | | |

3. Toxicity assessment for contaminants at Superfund sites generally consists of two steps: hazard identification and dose-response assessment. Hazard identification documents substances at a site that could cause an adverse health effect if people are exposed to them. Dose-response assessment takes place separately from site-specific investigations. This assessment estimates the relationship between the amount of exposure to a substance and the potential health effect. Scientists base dose-response determinations on animal studies, limited human health data and assumptions about long-term exposure. Any human health data usually comes from industrial accidents or other types of accidental human exposures that provide information about the

health effects of different substances. State and federal regulations limiting the amounts or concentrations of contaminants in soil, water and air at the point of exposure are typically based on dose-response assessments.

4. Risk characterization calculates the human health risk associated with contaminants at a Superfund site. The calculation is based on information from the first three steps of the risk assessment – data evaluation, exposure assessment and toxicity assessment. In addition, characterizing risk involves discussing uncertainties associated with each step of the risk assessment process. The 2000 BHHRA for OU1 includes the calculation formulas used to calculate risk.

Noncancer health risk is measured by the hazard index (HI). The HI is the sum of the hazard quotients (HQs) for each contaminant of concern in the risk assessment. If the HQ for a substance that a person is expected to be exposed to at a Superfund site is less than 1, no adverse health effect is expected. The HQ is calculated by dividing the concentration or amount of substance a person could be exposed to by a reference dose (RfD) or reference concentration (RfC) determined during the dose-response assessment.

The RfD is the daily oral exposure not likely to cause adverse noncancer health effects in humans over a lifetime of exposure. The RfD usually includes sensitive subgroups such as children and pregnant women. The RfC is the concentration in air where continuous inhalation is not likely to cause adverse noncancer health effects over a lifetime of exposure. If the sum of the HQs or the HI at a Superfund site is greater than 1, EPA generally requires further action.

Cancer health risk is calculated differently than noncancer health risk. The BHHRA assumes that any exposure results in increased risk of developing cancer. Cancer risk is expressed as the extra lifetime risk of cancer due to contaminant exposure. It is expressed with numerical values. A cancer risk of $1\text{E-}04$ or 1×10^{-4} means an extra lifetime cancer risk of 1 in 10,000. A cancer risk of $1\text{E-}06$ or 1×10^{-6} means an extra lifetime cancer risk of 1 in a million. If the extra lifetime cancer risk is 1 in a million or less, EPA does not generally require cleanup at a Superfund site. If

the extra lifetime cancer risk is greater than 1 in 10,000, EPA generally requires further action to reduce the risk. For cancer risk between 1 in 10,000 and 1 in a million, EPA makes cleanup decisions on a site-by-site basis.

Summary

A BHHRA evaluates human health risk associated with contaminants found in soil, water and air at a Superfund site. Risk is calculated for all potentially completed exposure pathways. If site-related contaminants are found off site and are above EPA screening levels, off-site exposure pathways are considered and off-site risks are calculated for all potentially completed pathways. Risks are not calculated for potential new exposure pathways that could occur from future natural disasters.

The 2000 BHHRA for OU1 concluded that the HI for all current and future exposure scenarios was less than 1. This means that no adverse noncancer health effects are expected from site-related contaminants identified for inclusion in the BHHRA.

The 2000 BHHRA for OU1 also concluded that cancer risk for current exposure scenarios was within EPA's target risk range of 1 in 10,000 to 1 in a million excess lifetime cancer risk. The maximum current cancer risk was to groundskeepers working next to Area 2. An excess lifetime cancer risk of 4 in 100,000 was calculated for the groundskeepers.

The groundskeepers, adjacent building users, storage yard workers for Areas 1 and 2, and Ford property groundskeepers were evaluated under projected future conditions (exposure to gamma radiation from below a graveled or paved parking lot). The evaluation indicated that the cancer risk to a future groundskeeper on the Ford property falls within EPA's target risk range. However, workers accessing Areas 1 and 2 in the future have potential excess lifetime cancer risks greater than 1 in 10,000. The greatest risk was to storage yard workers in Area 2, with a calculated excess lifetime cancer risk of 4 in 10,000. Currently, access to Areas 1 and 2 is limited, and on-site workers are monitored for radiation exposure.